

JEE Main Current Electricity and Magnetism Solved Questions

Q1. Two wires of lengths 1 m and 2 m, same material, have resistances R and 2R. Find ratio of cross-sectional areas.

Solution

$$R = \rho L/A \Rightarrow R_1/R_2 = (L_1/A_1) / (L_2/A_2) = 1 / 2$$

$$1/A_1 / 2/A_2 = 1 / 2 \Rightarrow A_1/A_2 = 1 / 2$$

Answer: $A_1:A_2 = 1:2$

Q2. A $2 \mu\text{F}$ capacitor is charged to 100 V. Find energy stored.

Solution

$$U = \frac{1}{2} CV^2 = 0.5 \cdot 2 \times 10^{-6} \cdot 100^2 = 0.01 \text{ J}$$

Answer: 0.01 J

Q3. A circular coil of radius 0.05 m carries 2 A. Find magnetic field at center.

Solution

$$B = \mu_0 I / 2R = 4\pi \cdot 10^{-7} \cdot 2 / 2 \cdot 0.05 = 8\pi \cdot 10^{-6} \approx 2.51 \times 10^{-5} \text{ T}$$

Answer: $2.51 \times 10^{-5} \text{ T}$

Q4. Find the equivalent resistance of three 6Ω resistors in parallel.

Solution

$$1/R = 1/6 + 1/6 + 1/6 = 3/6 = 1/2$$

$$R = 2 \Omega$$

Answer: 2Ω

Q5. A 10Ω resistor is connected to a 6 V battery. Find power dissipated.

Solution

$$P = V^2 / R = 6^2 / 10 = 3.6 \text{ W}$$

Answer: 3.6 W

Q6. A current of 4 A flows for 3 minutes. Find the total charge.

Solution

$$T = 3 \cdot 60 = 180 \text{ s}$$

$$Q = It = 4 \cdot 180 = 720 \text{ C}$$

Answer: 720 C

Q7. Two resistors 8Ω and 12Ω are connected in series across 20 V. Find voltage across each.

Solution

$$\text{Total resistance } R = 20 \Omega$$

$$\text{Current } I = 20/20 = 1 \text{ A}$$

$$\text{Voltage across } R_1 = IR_1 = 1 \cdot 8 = 8 \text{ V}$$

$$\text{Voltage across } R_2 = 1 \cdot 12 = 12 \text{ V}$$

Answer: $V_1 = 8 \text{ V}$, $V_2 = 12 \text{ V}$

Q8. A 1 m long wire carries 2 A. Find the force if placed perpendicular to a 0.1 T magnetic field.

Solution

$$F = BIL = 0.1 \cdot 2 \cdot 1 = 0.2 \text{ N}$$

Answer: 0.2 N

Q9. A 12 V battery is connected to a 4Ω resistor. How much charge flows in 5 s?

Solution

$$I = V/R = 12/4 = 3 \text{ A}$$

$$Q = It = 3 \cdot 5 = 15 \text{ C}$$

Answer: 15 C

Q10. A wire carries a current of 5 A. Find the torque on a rectangular loop (0.1 m

× 0.2 m, 10 turns) in a 0.05 T magnetic field.

Solution

Torque $\tau = NIAB \sin\theta$, assume $\theta = 90^\circ$

$$A = 0.1 \cdot 0.2 = 0.02 \text{ m}^2$$

$$\tau = 10 \cdot 5 \cdot 0.02 \cdot 0.05 = 0.05 \text{ Nm}$$

Answer: 0.05 Nm

Q11. A wire of resistance 2Ω carries a current of 3 A. Find the potential difference across it.

Solution

$$V = IR = 3 \cdot 2 = 6 \text{ V}$$

Answer: 6 V

Q12. Find the energy stored in a $5 \mu\text{F}$ capacitor charged to 50 V.

Solution

$$U = \frac{1}{2} CV^2 = \frac{1}{2} \cdot 5 \times 10^{-6} \cdot 50^2 = 6.25 \times 10^{-3} \text{ J}$$

Answer: 6.25 mJ

Q13. A capacitor of $10 \mu\text{F}$ is connected to a 100 V battery. Find the charge stored.

Solution

$$Q = C \cdot V = 10 \times 10^{-6} \cdot 100 = 10^{-3} \text{ C}$$

Answer: 1 mC

Q14. A current of 2 A flows through a resistor of 5Ω . Calculate the heat produced in 10 s.

Solution

$$H = I^2 R t = 2^2 \cdot 5 \cdot 10 = 200 \text{ J}$$

Answer: 200 J

Q15. A conductor rod of length 0.5 m moves perpendicular to a uniform magnetic field of 0.3 T with a velocity of 4 m/s. What is the emf induced between the ends of the rod?

Solution

Motional emf: $\varepsilon = B \ell v = 0.3 \times 0.5 \times 4 = 0.6 \text{ V}$

Answer: 0.60V

